The Minuteman

Volume 24 Issue 3 January 1994 95

The President's Corner

You're really gonna enjoy our January meeting program...we have Todd Gross, WA2MAK, one of Channel 7's meteorologists coming to talk about every ham's favorite subject: the Weather. We don't know at this point exactly what aspect of the weather he will deal with, but I'm sure it will be engrossing....

So plan to come to the Campion Center on the third Wednesday of this month...see the meeting announcement box for the details. Hopefully we will not be treated to a bad weather event for the meeting.

As you will read elsewhere in this issue, the Taunton 449.575 machine is on the air! Thanks to the efforts of Chris Conti, N1NVL, who organized the effort. Thanks also to all the guys who worked on the project — they are named in the article. I'm sure that it won't be long before the repeater is a full time member of the network. Once it is, you should be able to work the network from as far south as Providence and the base of the Cape.

This has been another example of what happens when a bunch of people come out to get involved and help. If that kind of stuff continues to grow, there's no limit to what we can accomplish.

The MMRA is now on the mailing list for technical bulletins from Kenwood. Frank, KB1FZ, got a letter from them saying that Kenwood was going to reach out to amateur radio clubs. So he responded, and we got our first batch of stuff from them. They plan to establish a newsletter that will go out to all clubs that will include stuff like new equipment announcements (before the magazines have them), hidden feature instructions, and profiles on participating clubs.

One of Kenwood's purposes is to get ideas for their equipment designs and feature packages from the ham community. So any ideas you have about equipment can be funnelled to Kenwood through the MMRA. Just send them to our P.O. Box in Lexington and we'll forward them. You can also access their bulletin board at 310 - 761 - 8284. It's free, and is on 24 hours. We have included some of the information they sent us elsewhere in this issue.

We resumed the fox hunts after the holidays on January 7; Bill N1QPR, was the fox. He had thrown down the gauntlet, challenging the erstwhile hunters to get him in less than 3 hours. They got him in a little over two hours...our team of hunters is getting pretty good at it. We even gave Roger, W1OJ, a few chuckles as he listened while we coordinated team efforts on his Wachusett machine. He even drew a line for us, confirming our early suspicions as to the fox location. First in was Dave, KT1X. He promises a good hunt on the 14th on the Weston Repeater. So if you've got an old Yagi, a handheld or anything else that can receive 146.22 come on out. You'll have a lot of fun.

Don't forget the meeting — it should be a really good program, and you'll get to meet a lot of people!

Electromagnetic Interactions with Materials

By Dave Croll, KT1X

Part 3

In the first two parts of this series, we developed our knowledge of electromagnetic waves and fields, and their interactions with various materials. As we did this, we began to look at some phenomena of interest to hams. In this part, we will extend our knowledge of electromagnetics into the world of molecules, with an eye to understanding phenomena such as the absorption of microwaves by individual molecules. We will also be looking at the role of electromagnetic phenomena in determining signal losses over a variety of paths.

Although many electromagnetic phenomena can be understood in terms of theory which concentrates on waves and the bulk properties of matter, a more complete theory is needed to understand other important phenomena which will be of interest to us. This theory, quantum mechanics, is typically discussed in terms of mathematics. However, many of its important principles can be understood and immediately applied qualitatively.

One of the most important features of quantum mechanics is that it treats the interactions of energy and matter as the absorption or emission of an energy bundle or quantum. In the case of electromagnetic energy, the quantum particle is called a photon. This photon has energy and an associated wavelength.

Since the frequency of a wave is related to its speed of propagation and its wavelength, all absorptions of energy can be

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JANUARY MEMBERSHIP MEETING

WEDNESDAY, JAN 18, 1994 - 1930 HRS

CAMPION CENTER, WESTON MA

PROGRAM:

Todd Gross, WA2MAK

Channel 7 Meteorologist

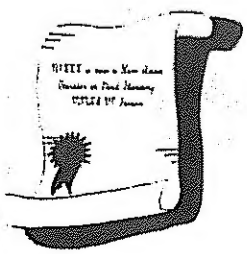
Association Update

Raffle

Kenwood Information

If you own a Kenwood TH22/42A, here's some information that might be of use..... There is an undocumented "cloning" feature that allows you to clone channel information from one TH22/42A to another.Here's how you do it....

1. Program the "master" radio channel and frequency information.
2. Select the same simplex frequency for both radios.
3. Turn all the radios off.
4. Re-power all radios while pressing "REV/SHIFT.
5. Display will read "Clone".
6. Connect a 50 Ohm dummy load to the master.
7. Press PTT on the master momentarily. The master will transmit DTMF tones to program the other radios. When the normal display returns, then turn all off all radios.



MMRA VE Sessions

Second Saturday of Each Month
Marlboro Public Library, 10AM
Contact: Bill Wade, K1IJZ
617-891-9079 Evenings 6 to 10 PM,
Weekends 8 AM to 10 PM.
Accredited - ARRL VE Program

Electromagnetic Interactions with Materials
Part 3

(Continued from page 1)

discussed quantum mechanically in terms of the frequency, or inversely the wavelength, of the photons. The wavelength and frequency of the photon are, of course, the link to classical electromagnetic waves.

Although this may not seem to be immediately applicable to everyday phenomena, a common quantum phenomenon is found in microwave cooking. In this technology, photons associated with microwaves are absorbed by individual water molecules in the substance being cooked. The absorption of energy from the photon causes a change, or transition, in the rotational motion of the water molecule, causing increased motion. The increased motion of the molecule causes collisions with other molecules, raising the temperature of the material. The same mechanism also operates during the microwave induced heating of biological tissues.

In the case of water molecules, a major absorption occurs at a frequency of about 2.45 GHz, the operating frequency of microwave ovens. In fact, the rotational transitions of all molecules which absorb microwaves are associated with photon absorption. The only difference is in the frequency i.e, wavelength, of the photon associated with the event. This depends in a non-trivial way on the molecular properties.

In addition to water molecules, other molecules found in the atmosphere can absorb microwaves. Among these is oxygen. Thus, individual molecules of water and oxygen in the atmosphere can absorb microwaves at specific frequencies. This absorption will be of significance at specific frequencies between 10 GHz and 200 GHz. While these are not heavily occupied frequencies at present, their use is growing, and they will become increasingly important in amateur radio of the future.

What are the losses due to absorption of microwaves by atmospheric water vapor and oxygen? Typical values for frequencies in the 10 GHz to 142 GHz range increase from 0.007 to 0.03 dB/kilometer for oxygen and 0.0004 to 0.13 dB/kilometer for water. Of course, the loss is dependent on the number of each type of molecule present. While the oxygen content of the atmosphere varies primarily with altitude, the water content can vary greatly depending on meteorological conditions.

The frequency dependence of molecular absorption of microwaves is based on the quantum properties of matter and energy. The bulk phenomena based on dielectric constants and permeability, discussed in Parts 1 and 2, also are frequency dependent. This dependence is determined by the molecules which compose the material and the way in which they are arranged in the material.

When evaluating losses as a function of frequency, one must consider all of the phenomena discussed above and in the first two parts of this series. While this can be a highly technical and time

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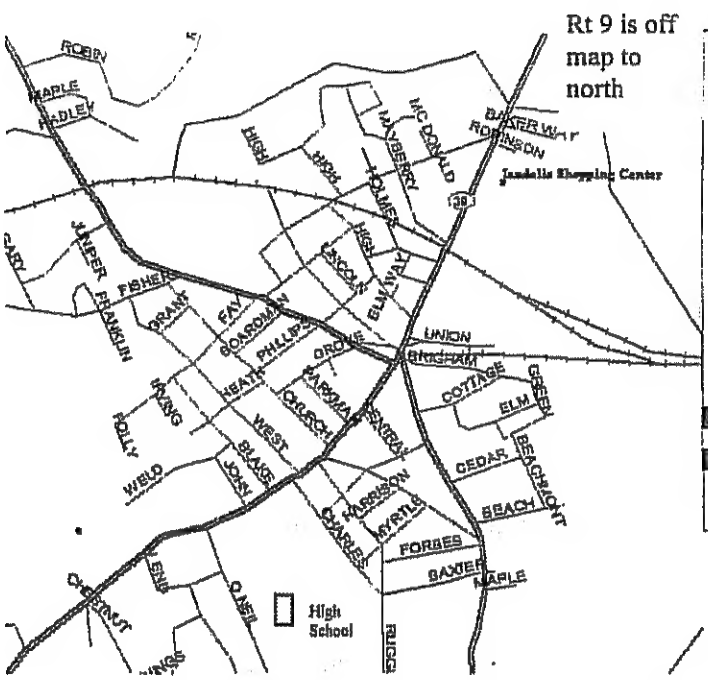
Amateur Radio Flea Sale

Sponsored by

The Minuteman Repeater Association

For Information or reservations call:
MMRA Voice Mail: 508-489-2282 — or
Andy Morrison, N1BHI: 508-481-3878



Westboro High School
Sunday, March 19, 1995
1000 - 1400 Hrs for Buyers
Open at 0800 for Sellers

General Admission: $2.00

Directions:

Take Rt 495 to Rt 9 west. From the intersection of Rt. 9 and 30, take route 30 "West" (goes south from Rt. 9). About 1 mile south you come into Westboro Center, entering a traffic circle. Go as straight as possible through the center, continuing on Rt. 30. As you approach the High School, you will see Church steeples right and left. The High School is just beyond the churches on the left.

	Before March 10	After March 10
5 foot table (1/2 of 10 foot)	$7.50	$11.00
8 foot table	$12.00	$18.00
10 foot table	$15.00	$22.00
Floor Space (BYO Table)	$.75 per foot 3 foot width	$1.25 per foot 3 foot width

Featured Vendor: *Lentini Communications* of Newington, CT. A Flea Market Special may be available.

Electromagnetic Interactions.....

(Continued from page 2)

consuming task, some generalities are applicable.

In the case of radio waves traveling through the atmosphere with frequencies other than those of microwave absorption, several effects predominate. The first of these is free space attenuation. Radiated energy decreases (attenuation increases) as the square of the distance. Also, the attenuation increases with frequency since as an antenna (Eg. an isotropic dipole) becomes smaller with increasing frequency, it absorbs proportionately less total radio energy from space. By taking these effects into account, one can arrive at the basic equation for free space path loss, Lfs.

Lfs = 32.45 + 20 log d + 20 log f, where d is the distance in kilometers and f is the frequency in MHz. Lsf is calculated in decibels (dB) using this equation. It is not uncommon for path losses of well over 100 dB to be found as one approaches the higher UHF and microwave frequencies.

Even at frequencies other than those of the microwave absorption phenomenon, there are path losses in addition to those predicted by the equation given above. These can occur due to the radio waves being scattered by various phenomena discussed in Part 1, or due to losses from dielectric or permeability related phenomena discussed in Part 2. These losses are found for a variety of atmospheric phenomena, including rain, snow, hail, fog and clouds, but can become pronounced for other objects, such as trees and other naturally occurring features.

Knife-edge diffraction, which is based on the principles discussed in Part 1, occurs when the path of a radio wave is bent around the peaks of well-defined ridges or mountain ranges. Knife-edge diffraction typically has path losses of 20 to 50 dB, even if the geometry gives rise to a path that would not otherwise exist. Losses from knife-edge diffraction increase rapidly at higher VHF frequencies and become quite large in the microwave region.

Objects which are not involved in knife-edge diffraction can still cause path attenuation. Although it is difficult to predict the exact value of this type of attenuation, it increases rapidly with frequency at UHF and above. This attenuation is also a function of the dimensions of the object, and importantly for our discussion, the material which makes up the object. The moisture content is extremely important in determining the value of attenuation, with increasing amounts of water causing increasing attenuation.

For instance, at 3.3 GHz, the losses through a brick wall will vary from 10 to 40 dB and are highly dependent on moisture content of the bricks. At 432 MHz, typical losses for trees range from 0.1 to 0.3 dB/meter. Increasing the amount of foliage on a tree will add greatly to the water content and have even more effect on attenuation than the less moist material from the trunk and branches. Thus, the seasonal effects of foliage on repeater coverage can be substantial at high VHF and above.

Not only do the interactions of materials with electromagnetic waves determine the path losses of radio communications, but they are critical for the technology of MRI imaging and are important in determining the biological effects of electromagnetic fields. In the next two parts of this series, we will focus on these important aspects of bioelectromagnetics.

BIBLIOGRAPHY

1. Atkins, P.W., **Physical Chemistry 5th edition.** W.H. Freeman and Co., 1994.
2. Hecht, E., **Physics**, Brooks/Cole Publishing Co., 1994.
3. Pocock, E., in **The ARRL UHF Microwave Experimenters's Manual Antennas Components and Design.** The American Radio Relay League, Inc., 1990.

Tower Safety - A Reminder From Chris/N1NVL

At work the other day I was talking to a tower contractor and heard a story about one of their veteran employees working on a 150 ft water tank when for unknown reasons, he fell off. At about 2/3 of the way down he managed to grab on to a work rope. By hugging the rope he slowed himself enough so that when he hit he only suffered broken feet and severe rope burns. He spent a week in the hospital; he is now in a walking cast and is looking forward to getting back to work. Let's face it, he got a second chance — not every story ends this way! Just a reminder that when you get up on that roof or tower, do it safely. Think about what you are doing, keeping your mind on the job! Be sure you know what you are doing, and plan your climb step by step. If you aren't sure just what to do in a given situation, find someone with experience and ask! So keep those tower or roof jobs safe — we want you around for a while so we can enjoy your company on the repeaters!

Norwood Amateur Radio Club to Hold Classes

Novice / Technician Classes - room for 30 students
Location: Westwood Police Department, Rt 109
Date: January 20, 1995 - first meeting for planning.
Classes now planned for Fridays, 7 to 9PM, 12 weeks.
Contact K1CB, Ed Lajoie 617-762-7142 (Ans. Machine)

Editors Note: Dave hangs out on 146.82 most days and is one of our regular net control ops on Tuesdays. Feel free to grab him and ask any questions you might have.

Repeater Report....

By Chris Conti N1NVL
Including stuff from Sept 1994 until Jan 1995

146.670 KA1HKP/R Quincy, MA

Some weird sounds were heard on the machine, so Mike, KA1HKP, started thinking it might be the power-amp desoldering itself again. Then it started making all sorts of noise on other repeaters and sending spurs across the galaxy, so the weekend of Oct 29 it had to be put to sleep. Mike removed the Power Amp, did lotsa re-soldering and re-work and placed it back in service quickly. A round of applause for Mike [Crowd Cheering]. Mike then got the Scom7k controller and was busy programming and learning all about what makes it tick. He was got it after the last meeting at 10:30 pm, and by morning was busy loading it up... Special thanks to Walter N1HBR, our software guru, for also staying up late after the meeting to get the final touches on the software. He found the one bug I kinda knew was there but didn't know why. Walter's painful attention to detail and perfection dug up this little gem that made the patch say "please hold" more then once. Soon thereafter the controller went into Quincy [Fanfare Music]. All seem to enjoy the new stuff. Remember the autopatch now acts the same as all the other autopatches, so use the same ON and OFF codes as on the Membership card... The TURN OFF code is different than the old "*" to turn off patch! OK OK so the Quincy Machine started saying PL Out 146.2 - Weelll I kinda accidently left that in from the Stoneham load of software... and I know it confused a lot of people... SORRY!

146.820 KA1AL/R Weston, MA

In September the Power Amp started acting up and running flaky. Every time I went up there to watch it run, it ran just fine. As soon as I left the site — Poof off it went! We pulled it out to run on the bench so it would break while under observation. Well, it croaked and Bryan, KA1YQB, found a couple of obscure intermittent connections between the RF transistors, the boards and the grounds. He got everything back to the same DC and RF potential, put it all back together and reinstalled it. Now the amp is playing fine.

449.575 N1NVL/R Taunton, MA

Well folks, another machine joins the network! On Sunday December 18 the Taunton machine made its appearance... See also the article and nifty pictures somewhere else in this newsletter. Thanks again to Bill N1KUG, Jim ND1N, and Dave KA1DTA for climbing the tower. Arnie N1SZS, John N1OTY, Bruce N1JJH, and Charlie (about to become a ham) for the ground support.

449.925 N1HBR/R Marlboro, MA

A new more powerful and better sounding transmitter is now being assembled from donated materials.... We are waiting for crystals.... Right now a temporary amp is running 25 watts.!

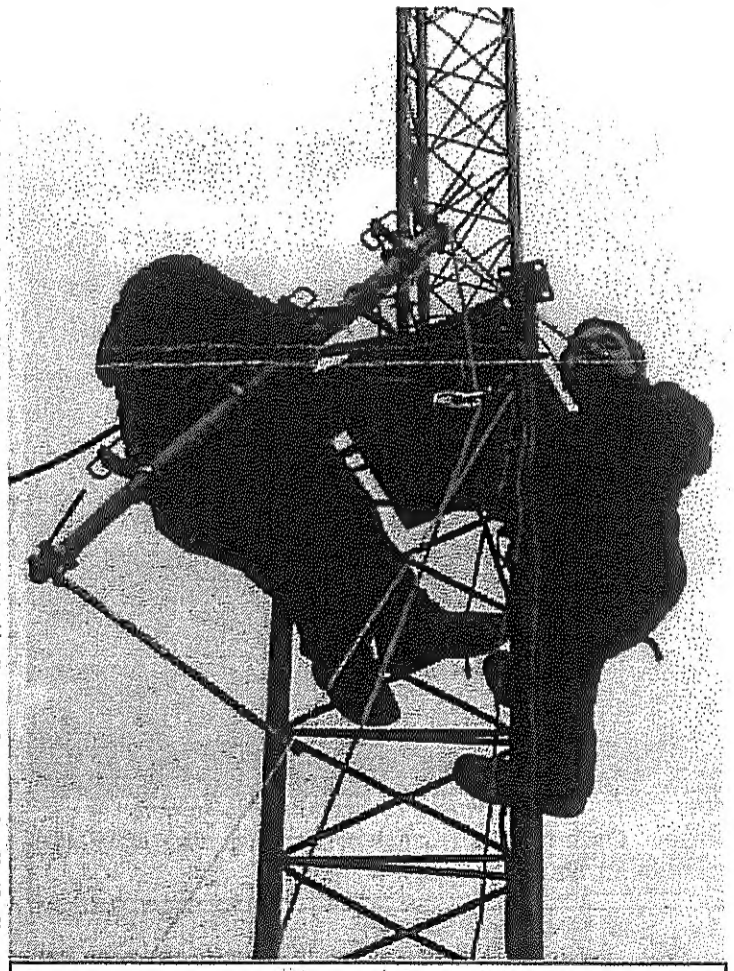
224.400 N1KUG/R Quincy, MA

This tempermental machine has decided to once again fail during extreme cold, so while we had a crew on the tower in taunton, Bill, N1KUG, pulled it out for bench work. So far he has found some bad solder joints and broken wires. More to come.

Another Repeater on the Network !

After voting in the purchase of the former W1OJ 449.575 Repeater it's now in service for the MMRA on the tower that houses 147.135 ND1N Repeater. The tower is owned by the Pilgrim Amateur Wireless Association (PAWA) in Taunton.

PAWA voted to allow us to go on their tower and even offered to help put it up! Dave KA1DTA and Jim ND1N were a big help in securing the site. The PAWA crew included Dave KA1DTA, and Arnie, N1SZS. The MMRA crew consisted of Bill, N1KUG, Bruce, N1JJH, and Chris N1NVL. Charlie, Bruce's friend, and soon-to-be a Ham, came to help out. All gathered on Sunday Dec 18 at 1PM for an antenna raisin'. Bill N1KUG arrived just slightly early at 11AM and met up on the 147.135 repeater with Dave, KA1DTA, of PAWA. He's kinda the site manager.



You should be able to recognize Bill, N1KUG. He's the one looking down, contrary to the normal advice given tower climbers. As usual, we hams do all our tower work in lousy weather....

The preliminary rope hanging and other preparation got done. Chris, N1NVL, brought the repeater while Arnie, N1SZS, started in to the site. Bruce, N1JJH, had the most important job — he got the Coffee.

Brackets were assembled and modified to fit larger bolts. Bill, N1KUG, and Dave, KA1DTA did the climbing and other work aloft while Chris, N1NVL, assembled the machine. Bruce,

449-575 LINES.....

(Continued from page 5)

N1IJH, Arnie, N1SZS, and Charlie manned the ropes and pulled up the hardline for the repeater, 9913 for the link, Repeater antenna complete with side-arm brackets, and a 13 element yagi for the link. The frozen tower crew attached everything and secured the lines on the tower. Grounding kits were installed and

HERE CHRIS, N1NVL, WORKS ON FEEDLINE AND ADJUSTS THE LINK ANTENNA. ONCE THE LINK IS FULLY OPERATIONAL, WE'LL HAVE 440 COVERAGE ALL THE WAY DOWN TO PROVIDENCE!

all was ready by 4PM (not bad 'eh?).

More coffee was fetched and consumed and the on-air test was run. At this point a link test showed no link. When we listened to 146.61 we could tell the link was getting into 449.925 but couldn't hear it. A quick test with the IFR discovered the link had gone deaf. We pulled the link radio to be put on the bench for further testing. A drive test of the area showed some coverage problems, but we were out of time. Charlie is a professional photographer and did some nice action shots of the amazing crew in action!

DAY 2 - Monday night yours truly, Chris N1NVL, was back at the site along with Dave, KA1DTA, Walt, N1LHD, and Arnie, N1SZS, from PAWA. Initial diagnosis pointed to an old connector that was falling apart on the 1/2" hardline; a jumper on the duplexer was questionable along with a feedline jumper. All were replaced with fairly good results. More Coffee was consumed while we determined that the repeater still had a tendancy to work best in the southerly direction. More little things need to be worked out, but we had made some progress. Other credits go to Bryan, KA1YQB, and Clark, N1NVK, for refurbishing the link radio and antenna.

MORE - The New Years weekend found our crew back in action. On Dec 31st Bryan, KA1YQB, and Chris, N1NVL, drank coffee and went over the Link radio receiver.[*Editor's note: This proves the fact that while electron flow powers radios, coffee flow powers hams.*] On Sunday January 1 stuff was gone through to find a former Mobile Phone circa 1979 (470MHz). Tests were done on the bench to see if the Power Amp would function on the repeater. It did... Bryan made up some cables and soon we had 60W out from 0.5W in! Once again Bryan showed his talents by Disassembling the PA section and fitting it on a 19" rack panel from an old dead power supply. He added a fan he donated along with panel mount connectors and the like... But wait — there's more!

On Monday January 2 a Crew of Dave, KA1DTA, Jim, ND1N, braved the cold and wind to climb the tower again. More Coffee was consumed as John, N1OTY, and Chris, N1NVL, went back in to try and get the link up. The repeater antenna was reoriented for a more omnidirectional pattern and raised another 12 feet. Our heroes stayed on the tower, resoldering the link yagi connector and remounting the antenna as more seperation was needed. Arnie, N1SZS, once again showed up to lend a hand.

After Dave, KA1DTA, and Jim, ND1N, thawed out, more tests were run. Still no link, but we improved the range of the repeater. Then of course, Coffee. Later that Night Bryan and Dave installed the new Power Amp at full power. A fun time was had by all as they drove around and listening to the new repeater in places it had not been heard before.

Editor's Note: While all this was going on, Bryan, KA1YQB, was in the background quietly fixing our IFR. He got it running to spec again, solving the problems we found while doing the HT Clinic at Boxboro. Nice going, Bryan!

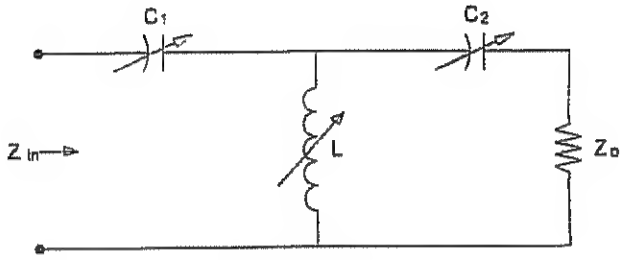
We thank Charlie for his efforts in making the photos you see here. We figured that some free advertising was the right thing to do....

THE PUZZLE CORNER

by Frank Morrison, KBIFZ

Congratulations again to Geoffrey, WA1EGL, for turning in a correct solution to the tuner problem, Figure 1. My solution to this problem goes as follows:

Figure One



C-L-C Tuner

Given the resistive and reactive components of the load Zo (antenna plus feed line), and the values of C1, C2, and L, what is the value of the input impedance Z_{in} for an input frequency of f MHz?

The impedances of C1, C2, and L (assuming perfect, zero resistance components, are

$$-j / 2\pi fC_1 = -jX_{C1} \qquad -j / 2\pi fC_1 = -jX_{C2} \qquad -j / 2\pi fL = -jX_L \quad (1)$$

respectively, where $j = \sqrt{(-1)}$. Let the given load impedance be $Zo = Ro + jXo$, where Xo can be either a positive (inductive) or negative (capacitive) reactance. Then the input impedance is

$$Z_{in} = -jX_{C1} + \frac{1}{\frac{1}{jX_L} + \frac{1}{R_O + j(X_O - X_{C2})}} \quad (2)$$

Eq. 2 must be simplified and separated into resistive (real) and reactive (imaginary) components. The process is shown by the following series of equations:

$$Z_{in} = -jX_{C1} + \frac{jX_L [\, R_O + j(X_O - X_{C2}) \,]}{R_O + j(X_O + X_L + X_{C2})} \quad (3)$$

$$Z_{in} = \frac{-jX_{C1} [\, R_O + j(X_O + X_L) - X_{C2}) \,] + jX_L [\, R_O + j(X_O - X_{C2}) \,]}{R_O + j(X_O + X_L + X_{C2})} \quad (4)$$

$$Z_{in} = \frac{X_{C1}X_L + (X_{C1} - X_L)(X_O - X_{C2}) - jR_O(X_{C1} - X_L)}{R_O + j(X_O + X_L - X_{C2})} \quad (5)$$

$$Z_{in} = \frac{[\, X_{C1}X_L + (X_{C1} - X_L)(X_O - X_{C2}) - jR_O(X_{C1} - X_L) \,] [\, R_O - j(X_O + X_L - X_{C2}) \,]}{R_O^2 + (X_O + X_L - X_{C2})^2} \quad (6)$$

Performing the multiplication indicated in the numerator of eq. 6, and separating the real and imaginary parts results in the desired result, where the resistive (real) part of the input impedance is

$$R_{in} = \frac{R_O X_L^2}{R_O^2 + (X_O + X_L - X_{C2})^2} \quad (7)$$

(Continued from page 7)

and the reactive (imaginary) part of the input impedance is

$$X_{in} = \frac{R_O^2(X_{C1} - X_L) + (X_O + X_L - X_{C2})\,[\,X_{C1}X_L + (X_{C1} - X_L)(X_O - X_{C2})\,]}{R_O^2 + (X_O + X_L - X_{C2})^2} \qquad (8)$$

The data given for the problem was C1 = 85.4 pF, C2 = 210.1 pF, L = 0.937 mH, Ro = 73 ohms, Xo = 100 ohms capacitive, and the input frequency = 14.2 MHz. For these values, the values of the tuner reactances are

$X_{C1} = 1 / (2\pi f C_1) = 1/(2\pi\ 14.2\text{x}10^6 \text{ x } 85.4\text{x}10^{-12}) = 131.24$ ohms

$X_{C2} = 1/(2\pi f C_2) = 1/(2\pi\ 14.2\text{x}10^6 \text{ x } 210.1\text{x}10^{-12}) = 53.35$ ohms

$X_L = 2\pi f L = 2\pi\ 14.2\text{x}10^6 \text{ x } .937\text{x}10^{-6} = 83.60$ Ohms

when these values are placed into eqs 7 and 8, the results are

$R_{in} = 50.05$ ohms and $X_{in} = 0.18$ ohms inductive

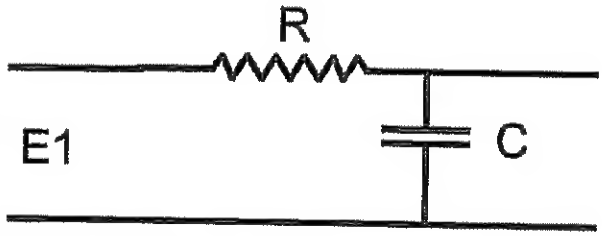
Thus the given load has been closely matched to a pure resistive source of 50 ohms.

Note that eq. 7 for the resistive (real) part of the input impedance is *independent* of C1, the tuner input capacitance. This appears to be a non-intuitive result, not anticipated nor expected. It says that only C2 and L affect the size of the resistive component, and that changing C1 affects only the cancellation of the reactive part of the load.

The major drawbacks of this high-pass-filter T-network type of tuner are that it will not attenuate any harmonics which the exciter/amplifier may generate, and the necessity of insulating the capacitors from ground. Its advantage over the L-C-L low-pass T-network tuner, which will attenuate such harmonics, is in the cost of high power roller or tapped inductances.

Here's a couple of new ones.

Given the simple RC low-pass filter shown in Figure 2. In terms of R and C, what is the frequency at which the filter output voltage is down by 3 dB from the input voltage?



Low Pass RC Filter

In what time would A, B, and C together do a job if A alone could do it in six hours more, B alone in one hour more, and C alone in twice the time?

Minuteman Repeater Association, Inc.
P. O. Box 2282
Lexington, MA 02173
Voice Mailbox:(508) 489-2282.

A Non-Profit Communications Organization Serving the Public in Time of Emergency.

-Application for Membership-

☐ *New* or ☐ *Renewal*
☐ *Individual Membership (Dues $25 per year)* ☐ *Family Membership (Dues: $35 per year)*
☐ *Novice Membership (1st year dues: $10)*

I hereby apply for Membership in the MINUTEMAN REPEATER ASSOCIATION, INC. I agree to abide by the rules and regulations of the Association as stated in the by-laws, and understand that acceptance of this application entitles me to all rights and privileges of membership as provided under the by-laws.

Signature: _____ Date:_____

Name: _____ Callsign:_____ Class of License:_____

Home Address: _____
_____
_____

Occupation: _____ Employer: _____
Work Phone#: _____ Home Phone: _____

Member of: ARRL?_____Other Clubs?_____

Equipment Available for Your Use:

Type	No.	Mobile	Port.	Fixed	DTMF	FM	SSB	Packet	CW	Patch	Rtty
HF	_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
VHF	_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
UHF	_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

I can and am willing to assist/serve the Association and/or help maintain the Repeaters in the following ways (check all appropriate boxes)

☐ Antennas
☐ Flea Market
☐ Receiver
☐ Publicity
☐ Transmitters
☐ Newsletter
☐ Logic
☐ Public Service
☐ Telephone
☐ Legal Aid
☐ Education:
☐ Technical Documentation
☐ Shelters
☐ Medical Aid
☐ Equipment Construction
☐ Meeting Set-up
☐ Equipment Transportation
☐ Social Events
☐ Technical Documentation
☐ Refreshment
☐ Schematic Drawing
☐ Technical Library
☐ Teach Code
☐ Teach Theory
☐ Repeater Tech Committee
☐ Special Projects
☐ Repeater Control Operator
☐ Association Officer
☐ Board of Directors
☐ Field Day
☐ Emergency Communications
☐ CW Operation
Other-Specify:_____

Send this form with your
Dues to: MMRA, PO Box 2282, Lexington, MA 02173

MMRA Information - Repeaters, Officers and Board Members

MMRA Repeaters:

Marlboro	146.61	N1BHI/R	FTL	P	
Marlboro	449.925	N1HBR/R	FTL	P	
Quincy	146.67	KA1HKP/R	PTL	P	
Quincy	224.40	N1KUG/R	FTL	L	PL - 103.5 in, none out
Weston	146.82	KA1AL/R	PTL	P	
Weston	224.70	N1HBR/R	FTL	L	
Hopkinton	223.94	N1BHI/R	FTL	L	
Stoneham	146.715	N1NVL/R	PTL	P	PL - 146.2 out, none in.
Stoneham	446.725	N1NVK/R	PTL	L	PL - 88.5 in, none out
Taunton	449.575	N1NVL/R	FTL	L	

[FTL = Full Time Linked PTL = Part Time Linked]
[L = Patch available via link] P = Local Autopatch]

MMRA Officers:

President:	Andy Morrison, N1BHI
Vice President:	Walter Ching, N1HBR
Secretary:	Frank Morrison, KB1FZ
Treasurer:	Ian MacLennon, AF1R
Clerk:	Clark Conti, N1NVK
Directors:	Tom Qualtieri, WB1GMA
	Al Kunian, KA1AL
	Chris Conti, N1NVL
	Mike Ryan, KD1OA
Newsletter Editor:	Andy Morrison, N1BHI
Associate Editor:	Walter Ching, N1HBR

To Contact Officers or Board Members Call MMRA Voice Mail Line:

508 - 489 - 2282
Toll Free from 508 and 617 Areas

Important MMRA Club Information:

Membership Meetings: 3rd Wed of Sept, Nov, Jan, Mar, May at Campion Center, Weston at 7:30 PM

Board Meetings: Meeting Dates for 1994-95 Season: September 21, November 16, January 18, March 15, & May 17.
3rd Wed of Oct, Dec, Feb, Apr. Meetings are open and members are welcome.
If a visiting member wants to be on the agenda, please contact Andy Morrison beforehand.

MMRA Voice Mailbox (508) 489-2282. -- This is a local call from any 508 exchange phone, and is a free call from both 617 and 508 areas.

Newsletter Information	September issue	November issue	January Issue	March Issue	May issue
Mailing Date	Sept 14, 1994!	Nov 9, 1994	Jan 11, 1994	Mar 8, 1994	May 10, 1994
Submission Deadline	Sept 10, 1994	Oct 26, 1994	Dec 28, 1994	Feb 22, 1994	Apr 26, 1994

The MMRA is dedicated to Amateur Radio and the public service. The MMRA is a registered non-profit Massachusetts corporation. Membership is open to all amateurs. Annual dues are $25.00 individual, $35.00 family.

Mail Return Address:

MMRA
P.O. Box 2282
Lexington, MA 02173

TO:

05 9509
Frank P Morrison
81 Old Garris
Sudbury, M